

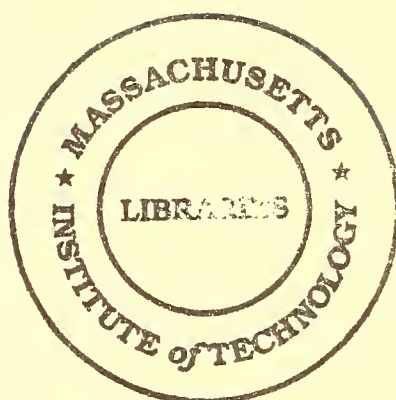
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Can Work-Sharing Work?

David Spector

No. 99-21

October 1999

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**WORKING PAPER
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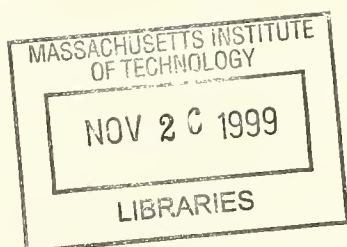
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ABSTRACT:

This paper assesses the effectiveness of work-sharing as a tool against unemployment, within a simple model where unemployment is induced by a binding minimum wage. To be effective, policies such as working time reduction or early retirement require that the workforce be homogeneous enough: The unemployed can then easily replace the freed up hours of work. We calculate the effects of work-sharing and of classical payroll tax reduction policies, as a function of some homogeneity measure and of the relevant elasticities. On the basis of existing empirical results, we estimate that in France, 2.5 hours of work must be removed to free up one hour of work: labor force heterogeneity makes work-sharing much less effective than a naïve analysis would predict, and payroll tax reductions are more cost-effective than work-sharing with income compensation.

Can work-sharing work?*

David Spector[†]

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Abstract

This paper assesses the effectiveness of work-sharing as a tool against unemployment, within a simple model where unemployment is induced by a binding minimum wage. To be effective, policies such as working time reduction or early retirement require that the workforce be homogeneous enough: the unemployed can then easily replace the freed up hours of work. We calculate the effects of work-sharing and of classical payroll tax reduction policies, as a function of some homogeneity measure and of the relevant elasticities. On the basis of existing empirical results, we estimate that in France, 2.5 hours of work must be removed to free up one hour of work: labor force heterogeneity makes work-sharing much less effective than a naive analysis would predict, and payroll tax reductions are more cost-effective than work-sharing with income compensation.

Keywords: unemployment, work-sharing, payroll taxes, minimum wages
JEL classification: E24, J21, J23, J31, J38

*I am grateful to Abhijit Banerjee, Francesco Giavazzi, and Jerry Hausman for their valuable remarks.

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1 Introduction

In the last two decades, European governments have experimented many policies designed to fight unemployment. The goal of this paper is to analyze and compare two broad classes of such policies: attempts to decrease the cost of labor through reductions in payroll taxes, or "classical" policies, as opposed to policies sometimes labeled in France as "malthusian", that is, policies trying to decrease labor supply using instruments such as early retirement, part-time employment, or incentives for mothers to stay at home¹. Comparing between these two broad classes is a particularly topical question, because France and Italy are currently engaged into large-scale policies of working time reduction.

Working time reduction, however, is not the main focus of this paper: it involves indeed many different aspects, making the overall analysis complicated and sometimes unclear (see next section). Our question is more basic: many European countries have followed, in the last two decades, massive malthusian policies other than working time reduction, of the kind mentioned above, simply by encouraging (or forcing) some individuals to stop working. These policies do not involve all the complicated issues that arise when working time is reduced: the organization of firms was not perturbed by them, and the government simply manipulated labor supply. Their rationale seems to make sense: if the level of minimum wages and payroll taxes induces an excess supply of labor, and increasing labor demand is hard - for example because its elasticity is small, and a big decrease in the minimum wage or in payroll taxes is politically impossible, or undesirable for distributional reasons - then the best the government can do is deal with the induced rationing, to allocate jobs in a socially efficient way. For example, encouraging mothers to stay at home achieves some equalization across households, while early retirement is legitimate if society considers youth unemployment to have the greatest social cost. Therefore, these policies, while

¹The expression "economic malthusianism" was coined by the French economist Alfred Sauvy, who used it to describe and condemn the working time reduction policy followed by the Popular Front government in 1936 (See Sauvy [1967]). He compared the underlying view of the economy to Malthus' population theory, in that it considered that the supply of jobs (equivalent to food supply in Malthus' theory) could not match the demand if the latter was not constrained (by restricting working time, the equivalent of restricting births). Although the expression is not used in English, we could come up with no other term to characterize this set of policies, and we will therefore use it throughout the article - without any value judgement.

keeping employment constant, would in fact transform unemployment into non-employment, by providing some unemployed with a less painful status - that of early retiree or mother at home. Of course, the logic is that of a one-to-one correspondence: every person retiring early frees up a job, causing unemployment to decrease by one unit.

Yet these policies do not seem to have reached their goals. In the case of France, they led to one of the greatest share of the population out of the labor force of all developed countries, without any visible impact on unemployment - quite the opposite². Of course, one may argue that unemployment would be even greater than it is, had these policies not been enacted. But given that the countries making the greatest use of them - France, Belgium, and Italy - did not fare better than other European countries in terms of unemployment (rather the opposite), this answer would imply that in the last twenty years, they suffered much more severe adverse shocks than their neighbors. Caution regarding this argument implies that we should look more closely at the rationale behind malthusian policies, formulate the conditions for their success, and check whether they are indeed met.

We believe that malthusian policies rely on one crucial assumption: the existence of a large and homogeneous population of low-skilled individuals, some of whom are forced into unemployment because minimum wage regulations prevent labor demand from increasing to match labor supply. If this view is right, then malthusian policies can make sense, because the unemployed and the low-skilled employed are substitutes, and the government may then decide who is to be employed - without affecting total employment, determined solely by labor demand.

However, this view of unemployment may be wrong for two reasons. First, even if the minimum wage is the culprit, this leaves open the question of the homogeneity of low-skilled individuals. If individual abilities differ, then unemployment is better described in terms of truncation than in terms of

²In 1997, the rate of labor force participation in the population aged 15 to 64 was 67%. In the European Union, only Belgium, Ireland, Italy and Spain had lower rates. But in these countries the female participation rates are much smaller than in France, probably for cultural reasons. The French rate may reflect the effect of malthusian policies, which caused the male participation rate to decline: at 74%, it is the lowest in the EU (together with the Belgian and Italian ones). Its fall by 8.5% between 1979 and 1997 was one of the largest of all OECD countries, matched only by Belgium, Italy, Sweden, and Portugal - in the last two cases, the decrease is part of a converging trend given the high initial levels. (see OECD [1998]).

rationing, as agents whose marginal productivity falls below the minimum wage end up unemployed. A malthusian policy then works less well than if agents are homogeneous: when some workers (or some working hours) are removed, the possible replacement comes from less productive individuals. But if the minimum wage does not change, then the wage faced by firms increases in terms of effective labor, causing total demand for effective labor to decrease. Second, according to another view, the minimum wage is unimportant, and there is no involuntary unemployment: the European labor market is simply in an equilibrium where many individuals, who voluntarily decide not to supply their labor because of the generosity of the welfare state, are wrongly counted as unemployed. The wage level then equates labor supply and labor demand, so that malthusian policies, artificially decreasing labor supply, cause wages to increase and total labor demand, as well as total employment, to decrease.

These two views are very different, but the reason for which they cast a doubt on the effectiveness of malthusian policies is the same: they preclude the possibility of moving individuals from non-employment to employment without increasing the wage per unit of effective labor. Therefore, assessing these policies does not require a definite view about the causes of unemployment, but simply about how elastic the supply of effective labor is - be it constrained by minimum wage laws or not.

We present a simple model allowing to estimate the effects of various classical and malthusian policies. On the basis of the existing empirical literature, we then try to assess which values should be substituted to apply our results to the French case. We find that once tax revenues are taken into account, a malthusian policy with full income compensation creates fewer jobs per amount spent than a uniform job subsidy. We also find that in order to free up an hour of work, the government must remove approximately 2.5 hours of work: malthusian policies are more than two times less effective than a naive analysis would predict.

This conclusion, while justifying skepticism regarding malthusian policies, also lends itself to a more positive interpretation: it implies that increasing the incentives for the unemployed to take a job, or providing the unemployed with adequate training, would have a strong effect on total employment.

2 Relation to the literature

The main ingredient of our analysis is the continuity of the distribution of types, which allows to discuss the effects of various policies in terms of the homogeneity of the ability distribution. This theme is surprisingly absent in the theoretical literature about unemployment, while it is, on the contrary, pervasive in empirical research, as well as in other parts of theory, like the theory of optimal taxation.

One of the few models analyzing unemployment explicitly in terms of truncation of a continuous ability distribution at the minimum wage is developed in Card and Krueger [1995]³. However, it deals only with the impact of minimum wages on unemployment, and not with the policy questions we investigate here. The style of our paper - a simple equilibrium model in which values for the relevant elasticities found in the empirical literature are substituted - is close to Piketty [1997], who models the impact of various fiscal policies on unemployment. But he considers heterogeneity simply by partitioning the population into two groups, the skilled and the unskilled, and rules out the possibility that the minimum wage is one of the main causes of unemployment - unlike this paper.

Most of the theoretical literature on work-sharing⁴ deals specifically with working time regulations, and is interested primarily in the nature of firms' production functions (increasing returns at the individual level make working time reduction costly, for example) and in the impact of working time regulations on wage bargaining. The conclusions reached by this literature are very diverse in terms of the effect of working time reduction on total employment, which is not surprising given the large number of technological and institutional variables.

On the empirical side, research assessing the effects of working time reduction has usually done so within a partial equilibrium analysis: Hunt [1999] for example analyzed the effects of working time reduction in Germany by comparing the evolution of employment across industries with different histories of working time reduction in the 1980s - and found little effect on overall employment.

The general equilibrium effect of restricting labor supply - the topic of this paper - is obviously much harder to assess empirically, because it works

³pages 360-364.

⁴See the survey in the introduction of Marimon and Zilibotti [1999], and Cahuc and Granier [1997].

through the general wage level (or unskilled wage level), which is subject to many other sources of variation, and cannot be inferred by comparing sectors diversely affected by working time regulations.

We address this effect by developing a simple model of the labor market, where employment is affected both by the minimum wage constraint and by individual participation decisions. We depart from most of the theoretical literature on the subject by thinking in terms of demand and supply rather than modeling the bargaining process. This does not reflect a view about the real world, rather it is the price we pay to simplify the model, given that we make it more complicated than the existing literature along another dimension, by considering a continuum of individual types.

3 The model

We consider an economy with two goods, labor and a consumption good⁵. Agents are heterogeneous along two dimensions: they have different abilities and different preferences between consumption and leisure.

An agent's ability is characterized by some $i \geq 0$, so that if his labor supply, measured in time units, is l , his "effective" labor supply is il . We assume that working time is exogenously determined by law to be equal to some l , so that the labor supply decision is simply the choice whether to work or not, or in other terms a choice between l and 0.

Total output is a function of total effective labor supply L given by

$$Y = f(L),$$

where f is increasing and concave⁶. Let s_i denotes the (endogenous) proportion of agents of ability i who choose to work. For simplicity, we assume agents' participation decisions to depend only on the hourly wage they face, but not on the legal working time⁷. We denote by $\varepsilon_{si} \geq 0$ the average wage

⁵In section 5, we show how our model can be applied to a world where there are two kinds of labor, skilled and unskilled.

⁶We are interested in short-run effects, meaning that the relevant time horizon is one where labor inputs can vary but not capital inputs. This functional form should then be viewed as the reduced form of a production function $g(K, L)$, with K constant in the short-run.

⁷This would be the case for example if each agent had a constant marginal rate of substitution between consumption and leisure, and s_i would then be the proportion of

elasticity of the labor supply of agents of ability i , and $g(i)$ is the density mass of agents of ability i . There exists a minimum wage legislation: hourly wages lower than some exogenous w_{\min} are not allowed. Total effective labor supply is then given by

$$L = l \int_{w_i \geq w_{\min}}^{\infty} i s_i g(i) di.$$

This can be rewritten as a function of w , the wage per efficiency unit (net of payroll taxes): the wage of an agent of ability i is indeed equal⁸ to $w_i = iw$, so that effective labor supply is given by

$$S(w) = l \int_{i \geq \frac{w_{\min}}{w}}^{\infty} i s_i g(i) di. \quad (1)$$

Similarly, labor supply measured in mass of workers (rather than in efficiency-weighted hours) is equal to

$$\Lambda(w) = \int_{i \geq \frac{w_{\min}}{w}}^{\infty} s_i g(i) di. \quad (2)$$

Let ε_d denote the wage elasticity of effective labor demand⁹ (in absolute value), given by

$$\varepsilon_d = -\frac{f'(L)}{L f''(L)} > 0.$$

Throughout the paper, we are going to write i_{\min} for the ability corresponding to w_{\min} . Notice that, unlike w_{\min} , i_{\min} is endogenous (it is equal to $\frac{w_{\min}}{w}$).

agents of ability i for whom it is below the wage w_i offered to them (w_i denotes the wage net of payroll taxes). This assumption matters only if our results are applied to working time reduction. The evaluation of other malthusian policies does not need it.

⁸Equilibrium in the labor market implies that employers' costs are proportional to abilities. The identity $w_i = iw$, in terms of net wages, is true if payroll taxes have a constant rate, which we assume (see below).

⁹This is not the usual labor demand elasticity, expressed in terms of total hours of work or number of employed. We calculate later the elasticity of employment with respect to the minimum wage, which depends on ε_d as well as on the distribution of abilities in the population.

4 Short-run effects of various policies

We compare in this section the impacts of various policies aimed at fighting unemployment, in order to assess their effectiveness, measured in terms of cost per job created. We start by looking more closely at the elasticity of labor supply - taking the minimum wage into account. Differentiating (1) implies

Lemma 1 *The elasticity ε_s of effective labor supply is given by*

$$\varepsilon_s = \frac{wS'(w)}{S(w)} = \tilde{\varepsilon}_s + \beta \frac{w_{\min}}{w_{ave}},$$

where w_{ave} is the average wage,

$$\tilde{\varepsilon}_s = \frac{\int_{i_{\min}}^{\infty} i \varepsilon_{si} s_i g(i) di}{\int_{i_{\min}}^{\infty} i s_i g(i) di},$$

and

$$\beta = \frac{i_{\min} s_{i_{\min}}(w_{\min}) g(i_{\min})}{\int_{i > i_{\min}} s_i(iw) g(i) di}.$$

This expression has a simple interpretation, as its each term captures a different margin: the first one describes the "intensive" or behavioral margin - the decisions of agents for whom the minimum wage is not binding -, while the second one describes the extensive margin - the extent to which changes in w relax the truncation at the minimum wage. $\tilde{\varepsilon}_s$ is indeed a weighted average of individual labor supply elasticities, and β is a measure of how dense the ability distribution is near the ability i_{\min} corresponding to the minimum wage: the greater it is, the more agents there are in a small ability interval close to i_{\min} ¹⁰.

At the limit where there is a mass point at ability i_{\min} , β , and therefore ε_s , are infinite. It would mean that there is a mass of unemployed agents

¹⁰ β is equal to the proportion of the total labor force that there would be in an ability interval of length i_{\min} if the density of the ability distribution were everywhere the same as the actual density at i_{\min} .

identical to the mass of minimum wage workers, ready to work at the minimum wage. As said in the introduction, this seems to be the view implicitly held by the advocates of malthusian policies¹¹.

The following result, obtained by differentiating (2), characterizes the elasticity of labor supply measured in mass of individuals (that is, not weighted by ability) and describes the composition of the population at the margin of unemployment.

Lemma 2 *1. The elasticity ε_s of total employment with respect to w is equal to*

$$\hat{\varepsilon}_s + \beta,$$

where

$$\hat{\varepsilon}_s = \frac{\int_{i_{\min}}^{\infty} \varepsilon_{si} s_i g(i) di}{\int_{i_{\min}}^{\infty} s_i g(i) di}.$$

2. The average hourly wage of agents at the margin of employment is

$$\tilde{w} = \frac{\beta}{\beta + \hat{\varepsilon}_s} w_{\min} + \frac{\hat{\varepsilon}_s}{\beta + \hat{\varepsilon}_s} \frac{\int_{i>i_{\min}} w_i \varepsilon_{si} s_i g(i) di}{\int_{i>i_{\min}} \varepsilon_{si} s_i g(i) di}.$$

In general $\hat{\varepsilon}_s \neq \tilde{\varepsilon}_s$ because $\tilde{\varepsilon}_s$, unlike $\hat{\varepsilon}_s$, weighs elasticities by ability. Also, \tilde{w} is equal to w_{\min} if unemployment is entirely involuntary (so that $\tilde{\varepsilon}_s = 0$). In the remainder of the paper, we will often apply our results to the case where \tilde{w} is close to w_{\min} . This assumption can correspond to the view that European unemployment is mostly involuntary, but it is also compatible with the view that part of it is voluntary, if the labor supply of agents with low income prospects is much more elastic than that of more skilled agents¹².

4.1 Malthusian policies

Proposition 3 *Let τ be the tax rate applied to any kind of income, and s denote the share of labor in total output. If the government removes working hours corresponding to $\alpha\%$ of total wages paid in the economy, then*

¹¹If population heterogeneity were described, according to the "traditional" modeling style, in terms of two groups, the skilled and the unskilled, then β and ε_s would be infinite, and most of the discussions below would be obvious or meaningless.

¹²This simplifying assumption is justified in the French case, as we explain in the next section.

- (i) Aggregate output decreases by $\frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} \alpha \%$.
- (ii) The number of new jobs is

$$\frac{\varepsilon_s}{\varepsilon_d + \varepsilon_s} \frac{w_{ave}}{\tilde{w}} \alpha \%$$

of the number of employed.

- (iii) If the government compensates the artificially removed hours by paying them a fraction λ of what they were paid, then the cost per "freed up" job is

$$\tilde{w} \left[(1 + \varepsilon_d \varepsilon_s^{-1}) \lambda + \varepsilon_d \varepsilon_s^{-1} \tau \right].$$

Proof. See the appendix. ■

This formulation can of course be reversed and stated in terms of the consequences of putting some people to work (say, by improving job search assistance for the unemployed, or by delaying retirement): for example, if unemployment is entirely involuntary ($\tilde{w} = w_{\min}$), putting X agents to work (at the minimum wage) only destroys $\frac{\varepsilon_s}{\varepsilon_d + \varepsilon_s} X$ jobs, and total employment increases by $\frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} X$.

The interpretation of this coefficient is easy: the higher ε_s , the closer the economy is to the view described in the introduction as being the implicit view held by advocates of malthusian policies. At the limit where ε_s is infinite (meaning that there is a mass of identical unskilled agents), removed working hours are replaced in a one-to-one proportion (in efficiency terms), and a malthusian policy does not cause output to fall. This means that work sharing is useful, while, on the contrary, moving people from unemployment to work amounts to a simple displacement of the fixed quantity of labor. The converse holds, of course, if ε_s is low¹³.

Also, the more inelastic labor demand is (the lower ε_d), the more effective malthusian policies are. Indeed, even if there is a lot of population heterogeneity, so that ε_s is small, the fact that replacing exiting workers with less productive ones amounts to an increase in labor costs has no effect on total employment if labor demand is inelastic. This remark means that the characteristics of labor demand making malthusian policies efficient are the opposite of the ones required for "classical" payroll tax reductions to be efficient (see below).

¹³This discussion shows the importance of the continuum assumption: how relevant it is (as opposed to a model where the population is divided into two skill groups, for example) is the key question for policy assessments.

4.2 "Classical" policies

We investigate in this section the short-run effects of "classical" fiscal policies trying to increase employment by subsidizing it (for example by lowering payroll taxes). We are faced here with a difficulty: the analysis of the cost per job created through payroll tax reductions depends a lot on the initial structure of payroll (and other) taxes. In particular, it is well-known that any optimal tax scheme should involve a zero rate at the bottom (or even negative if the government's objective function takes unemployment into account). This can easily be understood in the context of our model. If the payroll tax paid at the minimum wage is strictly positive, the following change in the tax scheme increases both employment and government revenue: a decrease of ε in the tax paid at the minimum wage, phased out linearly so that the payroll tax is unchanged at $w_{\min} + \varepsilon$ yields a second-order "direct" revenue loss (coming from the decrease in revenue collected between w_{\min} and $w_{\min} + \varepsilon$), but a first-order increase in employment, and therefore in revenue if the tax paid at the minimum wage is positive.

Real world tax schemes are far from the optimal schemes predicted by theory. In particular, the payroll tax at the minimum wage is usually positive, implying the possibility of simultaneously increasing employment and revenue. How should we, then, assess the cost of each job created through payroll tax reductions? We assume¹⁴, as in the previous section, that initially all income is taxed at rate τ , and we restrict our attention to simple policies, such as a uniform decrease in the tax rate, or a uniform lump-sum reduction in payroll taxes. However, Proposition 5 allows to assess the effect of other policies as well, by expressing the effect on total employment as a function of the decrease in taxes paid at the minimum wage only.

Proposition 4 *If payroll taxes are decreased uniformly by $\alpha\%$, then*

- (i) *Aggregate output increases by $(\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} s \alpha\%$.*
- (ii) *Total employment increases by*

$$(\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} \frac{w_{ave}}{\tilde{w}} \alpha\%.$$

- (iii) *The cost to the government of every new job is*

$$\tilde{w}(\varepsilon_d^{-1} + \varepsilon_s^{-1} - \tau).$$

¹⁴This assumption is, in the case of France at least, close to reality (see Bourguignon and Chiappori [1997], Bourguignon and Bureau [1999]).

Proof. See the appendix. ■

Unsurprisingly, the number of new jobs is an increasing function of both the labor demand elasticity and the labor supply elasticities.

If $\tilde{w} = w_{\min}$ (for example if unemployment is entirely involuntary), then the only important element of a change in payroll taxes is the change at the minimum wage. This implies that a change in payroll taxes decreasing the tax owed for minimum wage earners by $\alpha\%$ has the same effect as a uniform decrease of the tax rate by $\alpha\%$. Applying Proposition 4 yields then

Proposition 5 *Suppose that $\tilde{w} = w_{\min}$. Then, decreasing payroll taxes paid at the minimum wage by $\alpha\%$ has the following consequences:*

- (i) *Aggregate output increases by $(\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} s \alpha\%$.*
- (ii) *Total employment increases by*

$$(\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} \frac{w_{ave}}{w_{\min}} \alpha\%.$$

(iii) *If the decrease of the tax paid at the minimum wage is achieved by a uniform per-job subsidy, then the cost to the government of every job created is*

$$w_{\min} \left[\frac{w_{\min}}{w_{ave}} (\varepsilon_d^{-1} + \varepsilon_s^{-1}) - \tau \right].$$

This result allows to assess the effect of changes in the real value of the minimum wage on total employment in case unemployment is mostly involuntary. Indeed, if $\tilde{w} = w_{\min}$, then part (ii) implies:

Corollary 6 *Suppose that $\varepsilon_s = 0$, so that $\tilde{w} = w_{\min}$. Then the elasticity of total employment Λ to the minimum wage, denoted $-e$ hereafter, is equal to*

$$-e = -(\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} \frac{w_{ave}}{w_{\min}} = -\left(\frac{w_{\min}}{w_{ave}} \varepsilon_d^{-1} + \beta^{-1} \right)^{-1}.$$

4.3 Comparing the efficiency of malthusian and classical policies

Comparing propositions 3, 4 and 5 allows to make simple statements about the relative efficiency of various policies:

Proposition 7 1. *A uniform reduction in the rate of payroll taxes creates*

$$\frac{(1 + \varepsilon_d \varepsilon_s^{-1})\lambda + \varepsilon_d \varepsilon_s^{-1} \tau}{\varepsilon_d^{-1} + \varepsilon_s^{-1} - \tau}$$

more jobs per amount spent than a malthusian policy with a compensation rate of λ , once the change in tax revenue brought about by the change in output is taken into account.

2. *If $\tilde{w} = w_{\min}$, then a uniform subsidy per job creates*

$$\frac{(1 + \varepsilon_d \varepsilon_s^{-1})\lambda + \varepsilon_d \varepsilon_s^{-1} \tau}{\frac{w_{\min}}{w_{ave}} (\varepsilon_d^{-1} + \varepsilon_s^{-1}) - \tau}$$

more jobs than a malthusian policy with a compensation rate of λ .

Unsurprisingly, the comparison is more favorable to classical policies, the greater the elasticity of the demand for effective labor: a high elasticity makes classical policies more efficient and malthusian ones less efficient. The effect of ε_s is ambiguous, which is not too surprising since both kinds of policies are more efficient if ε_s is high: if it is equal to zero, then there are no "marginal" workers in the vicinity of the threshold ability w_{\min} , and nothing can be done whatsoever!

Note also that taking into account the effect of output change on tax revenue makes the comparison more favorable to classical policies, because they cause an increase in output, while malthusian ones cause output to decrease¹⁵.

Before applying these results, we need to justify our focus on the short-run impact of policies. If in the longer-run the capital stock can adjust, and capital is costlessly mobile across countries, then the interest rate, and therefore (if the aggregate production function exhibits constant returns to scale) w , are determined in the long-run by world prices. This long-run constancy of w implies that malthusian policies are completely ineffective in the long-run: an hour of work artificially removed is not replaced at all. On the contrary, classical policies become more efficient in the long-run, for the decrease in labor costs increases capital profitability, and therefore the capital stock, and net wages - while employers' labor costs go back to their initial

¹⁵This result, one of the few points of agreement of the literature on working time reduction (see the introduction of Marimon and Zilibotti [1999]), is rarely mentioned in the public debate about the merits of various policies.

level. Therefore considering long-run effects would shift the comparison in favor of classical policies.

However, we believe that focusing on the short-run may be justified in the European case, given the possibility that transitory impacts on employment become permanent: a large body of literature¹⁶ on European unemployment stresses indeed the importance of hysteresis phenomena, by which individuals temporarily unemployed tend to lose their skills (or morale) and end up being long-term unemployed, economically equivalent to individuals out of the labor force, even though they may be counted as unemployed.

5 Applying the model to the French case

How do back-of-the-envelope calculations allow to think about policy issues in the light of this comparison? We assume throughout this section that $\tilde{w} = w_{\min}$, which seems justified in the French case¹⁷. First, note that by Proposition 7, a sufficient condition for a uniform per-job subsidy to be more efficient than a malthusian policy with full replacement is that

$$\varepsilon_d \geq \frac{w_{\min}}{w_{ave}} (= 0.5).$$

This condition is independent of ε_s , so we start by discussing the relevant range of possible values for ε_d .

5.1 Assessing the value of ε_d

The immediate, most naive way to assess ε_d , is to take our model literally, that is, to assume labor to be homogeneous, and the production function $f(L)$ to be a reduced form of the function $g(L, K_0)$, where $g(L, K)$ is the true production function, and K_0 is the stock of capital, constant in the

¹⁶See Blanchard and Summers [1987].

¹⁷Laroque and Salanie [1999] find (in our vocabulary) that β is significantly larger than $\tilde{\varepsilon}_s$ (changes in employment come mostly from changes in how binding the minimum wage is), although changes in participation decisions, captured by $\tilde{\varepsilon}_s$, are not completely negligible (in particular for women). They find that groups with the lowest earnings prospects have the greatest labor supply elasticity, implying that \tilde{w} is close to w_{\min} . This last finding (echoing that of Eissa and Liebman [1996]) is not surprising given the existence of the social safety net: an increase in earned income by 1% means a greater proportional increase in disposable income at the lower end of the income distribution.

short-run. If ε is the elasticity of substitution in production between capital and effective labor, then a simple calculation shows that the elasticity of effective labor demand relative to wages, holding K_0 constant, is equal to

$$\varepsilon_d = \frac{\varepsilon}{1-s},$$

where s is the share of labor in output. When this modeling is accepted (that is, under the unrealistic assumption that there exists only one type of labor), ε is thought¹⁸ to be close to 1. In France, s is close to 60%, implying, if $\varepsilon = 1$, that $\varepsilon_d = 2.5$. This would imply that a uniform per-job subsidy is more than five times more effective than a malthusian policy, whatever the value of ε_s !

This estimate is not convincing however, because the assumption that there exists only one type of labor is very much at odds with reality. A more satisfactory approach, then, is to take into account the heterogeneity of the labor force - not in the sense of different individual abilities, as we did throughout the model, but in the additional sense that labor inputs supplied by unskilled and skilled workers do not necessarily enter into the production function additively, or, in other words, in the sense that there may exist some complementarity between various types of labor inputs. This seems at first to raise a number of technical difficulties, for our analysis relies crucially on the continuity of individual types, while the complementarity between skilled and unskilled labor is often analyzed in discrete models for the sake of tractability. This problem, however, can be surmounted, as soon as one notices that, since $\tilde{w} = w_{\min}$, the only important variable for the demand side of the economy is the number α such that if total employment increased by 1%, and all new workers had ability i_{\min} , then the marginal productivity of workers close to the minimum wage would decrease by $\alpha\%$. If we assume, as much of the literature does¹⁹, that the production function is in fact some $h(L_u, m(L_s, K))$, where there is an ability threshold \bar{i} such that

$$\begin{cases} L_u = l \int_{w_i \geq w_{\min}}^{\bar{i}} i s_i g(i) di; & \Lambda_u = l \int_{w_i \geq w_{\min}}^{\bar{i}} s_i g(i) di \\ L_s = l \int_{\bar{i}}^{\infty} i s_i g(i) di; & \Lambda_s = l \int_{\bar{i}}^{\infty} s_i g(i) di, \end{cases}$$

¹⁸This is equivalent to the famous "stylized fact" about the relative constancy of the relative shares of labor and capital in aggregate output.

¹⁹See Freeman [1986] (pages 364-367) or Hammermesh [1993]. The empirical literature finds that capital and skilled labor are highly complementary, and that their combination is a substitute for unskilled labor.

then one can show (this is done in the appendix) that, if ε is the elasticity of substitution between unskilled labor and the combination of capital and skilled labor, then the relation between changes in low-skilled wages and changes in the quantity of low-skilled labor is the same as in our simple model with

$$\varepsilon_d = \varepsilon \frac{w_u \Lambda_u}{w_{ave}(\Lambda_s + \Lambda_u)} \frac{1}{1 - s_u},$$

where s_u is the share of unskilled labor in total output and w_u is the average unskilled wage. If the unskilled are the bottom half of the wage distribution, then with s still denoting the total share of both kinds of labor, s_u is equal to $\frac{1}{2}s \frac{w_u}{w_{ave}}$, and the last equation implies

$$\varepsilon_d = 0.5\varepsilon \frac{w_u}{w_{ave}} \frac{1}{1 - 0.5s \frac{w_u}{w_{ave}}}.$$

The empirical literature finds values of ε around 1.6, and the average wage of the bottom half of the population (a reasonable estimate for w_u) is approximately 60% of the average wage in France²⁰. Substituting these values (with $s = 60\%$) implies that

$$\varepsilon_d = 0.5\varepsilon \frac{w_u}{w_{ave}} \frac{1}{1 - 0.5s \frac{w_u}{w_{ave}}} \approx 0.6.$$

5.2 Assessing the value of ε_s

The difficulty in estimating ε_s is that it reflects the combined effect of two different factors: the "real" elasticity of labor supply and the density of the distribution of abilities close to the minimum wage. Each of these magnitudes is likely to vary greatly across countries. The elasticity of labor supply, defined as it is here, is in fact an indirect elasticity, which depends on the income and welfare benefits available to the unemployed, as well as on the extent of the social stigma associated to unemployment - all things highly variable in time and space. The distribution of skills around the minimum

²⁰Empirical studies generally define skilled labor as consisting of college graduates, that is, much less than the upper half of the income/skill distribution. This implies that our equation for ε_d (obtained by assuming the upper half to be skilled, and the lower half to be unskilled) is in fact underestimating the real value. Therefore our policy comparisons should be corrected in favor of classical policies, against malthusian ones.

wage is equally difficult the measure: in particular, trying to assess it by looking at the actual wage distribution is naive, for deviations from pure competition in labor markets can make the correspondence between wages and marginal productivities tenuous, especially near the minimum wage²¹.

However, as a first step, we may try to see where such naive calculations lead to. The singularity in the immediate vicinity of the minimum wage is so obvious that looking at the density there is unpalatable even to a naive economist. To get a very rough idea of the relevant magnitude, however, one can look at the average density in a larger interval, for example in the bottom half of the wage distribution: since the minimum and median wages are, respectively, equal to 50% and 80% of the mean wage, an interval of width w_{\min} where the density would be the same as the average density in $[w_{\min}, w_{\text{median}}]$ would contain 5/6 of the workforce, implying $\beta = 5/6$ which (if unemployment is entirely involuntary) leads to

$$\varepsilon_s = \beta \frac{w_{\min}}{w_{\text{ave}}} = 5/12 \approx 0.4.$$

Fortunately, an empirical study by Laroque and Salanie [1999] allows to do better: using data about adults aged 25 to 50, they jointly estimate a wage equation and a participation equation, using individual characteristics and the details of the tax-benefit system. This allows to infer directly the distribution of individual abilities. Translating their results into the language of our model²², they find that, on the population they study, β is equal to 0.5, and that $\tilde{\varepsilon}_s$ is close to zero (although it varies a lot across groups and is not negligible for married women), yielding as a reasonable approximation

$$\varepsilon_s = \beta \frac{w_{\min}}{w_{\text{ave}}} + \tilde{\varepsilon}_s \approx 0.25 + \tilde{\varepsilon}_s \in [0.25, 0.3].$$

This is less than the value of 0.4 resulting from our much less rigorous calculation above, but the disagreement between these two figures is in fact smaller than it seems at first glance, because of the sample restriction in Laroque and Salanie [1999]: they do not consider the young (who are paid less and are in general considered to have a more elastic labor supply) or people working

²¹There can be "bunching" at the minimum wage without minimum wage earners being identical. For example, if bargaining between firms and workers leads to a 50-50 division of the surplus, then all workers whose marginal productivity lies between w_{\min} and $2w_{\min}$ end up earning the minimum wage.

²²We explain this "translation" in the appendix.

part-time (who also tend to be overrepresented among low-wage earners). Taking these categories into account would probably raise the estimate of ε_s above the 0.25-0.3 interval, so that a range of 0.3 to 0.4 seems reasonable²³.

5.3 Quantitative estimates in the French case

We can now use these estimates ($\varepsilon_d = 0.6, \varepsilon_s = 0.4$) to translate the earlier results into numbers.

Proposition 8 *Substituting the values $\varepsilon_d = 0.6$, $\varepsilon_s = 0.4$, and $\tau = 0.5$ in the previous propositions yields the following:*

(i) *to free up a minimum wage job, the government must remove hours corresponding to 2.5 minimum wage jobs.*

(ii) *decreasing the cost of the minimum wage by $\alpha\%$ increases employment by $0.5\alpha\%$.*

(iii) *a malthusian policy with full income compensation costs $3.25w_{\min}$ per new job.*

(iv) *a per-job subsidy, phased out above w_{\min} so that the average subsidy in only $\delta(< 1)$ times the subsidy at w_{\min} , costs $(2\delta - 0.5)w_{\min}$ per new job.*

These results are strikingly favorable to payroll tax reductions: even a uniform subsidy costs less per new job than a malthusian policy with full income replacement. The comparison becomes even more favorable if one considers actual payroll tax reduction policies, which often phase out subsidies. For example, the phasing out in the payroll tax reduction scheme enacted in France in 1996 was linear, and the subsidy disappeared at 1.33 times the minimum wage. This made this policy cost less than 25% of what it would have cost had it taken the form of a lump-sum subsidy to all jobs. Substituting in (iv) with $\delta = 0.25$ implies that the rise in tax revenue caused by the rise in output approximately offset the reduction in tax rates, making this scheme costless!

²³These relatively low estimates are not surprising: they are in line with the broad picture that emerges from a quick browsing through the results of the annual job studies (enquete emploi). They show for example that controlling for age and gender, the unemployed are much less educated than even minimum wage earners. For example, among men aged 25 to 35, only 28% did not study further than Junior high school (holding only the "BEPC" degree), but the figure is 40% among minimum wage earners and jumps to 57% among the long-term unemployed. There is also a lot of anecdotal evidence of labor shortages even for rather unskilled jobs as soon as the unemployment rate falls below 10%.

6 Conclusion

Part (i) of the Proposition means that malthusian policies are 2.5 times less effective than the most naive thinking would lead one to believe (or 3.25 times if one thinks in terms of cost per freed up job). Although this figure is, of course, sensitive to the values we substitute in our results, the general idea that malthusian policies are less efficient than classical ones is robust to large enough changes in the relevant elasticities. For example, if labor demand elasticity is in fact one half of the value we substituted above (0.3 rather than 0.6), which shifts the comparison in favor of malthusian policies, the government still must remove 1.75 minimum wage workers to free up a job, and the cost per new job is (assuming full income compensation) above $2w_{\min}$, while the subsidy enacted in 1996 (see above) costs only $0.25w_{\min}$ per new job.

Notice also that the effect of output changes on tax revenue is not the main force driving the result - although it strengthens it. Not taking it into account, malthusian policies with full compensation would still cost $2.5w_{\min}$ per new job, as against $0.5w_{\min}$ for the policy enacted in 1996.

We believe our results may explain why malthusian policies followed by many European countries in the last twenty years have had such a small impact on unemployment and such a big one on total employment, just the opposite of their goal²⁴.

This does not mean that payroll tax reductions are the only policy option left. If 2.5 hours of work have to be removed in order to free up one hour of work, then moving X workers from unemployment to minimum wage jobs increases total employment by approximately $0.6X$ workers. Empirical research in the United States has shown that job search assistance greatly increases the probability for an unemployed person to find a job, at a relatively low cost²⁵. Our last estimate implies that the unemployed finding jobs thanks to such assistance do not merely displace other workers, but that instead total employment increases by 60% of the "initial" increase.

Also, despite the fact that variations in overall employment come from involuntarily unemployed individuals finding jobs, rather than from changing

²⁴The Netherlands, where working time per employee decreased by 13 % between 1985 and 1995 while the employment rate rose by 4.3%, can appear as an exception, but that period was also characterized by a falling minimum wage in relative terms (see OECD [1998]).

²⁵See LaLonde [1986, 1995]

participation decisions, some groups - married women and the young above all - have much higher participation elasticities than average. Targeting incentive schemes - similar to the Earned Income Tax Credit in the United States - toward these groups would increase total employment by 60% of the observed impact on the targeted group.

One of the weaknesses of payroll tax subsidies is that their existence is not always perceived by firms, especially small businesses²⁶. On the contrary, improved incentives at the individual level seem to have quick effects, even when individuals do not clearly understand the workings of the incentive scheme²⁷. Therefore targeted incentives to leave unemployment should probably not be ignored altogether. Last but not least, they also have the advantage of a more left-wing flavor - so far the monopoly of inefficient malthusian policies - than payroll tax subsidies, making them more feasible in the present European political context.

²⁶Philippon and Kramarz [1999] show this by providing evidence of the asymmetric effect of (well publicized) minimum wage hikes and of payroll tax reductions.

²⁷See Eissa and Liebman [1996].

7 Appendix

Proof of Proposition 3:

Removing working hours corresponding to $\alpha\%$ of total wages means decreasing effective labor supply, in relative terms, by $\alpha\%$. If the rate of payroll taxes is τ , then the wage per unit of effective labor faced by employers is $w(1 + \tau)$, and labor demand is therefore

$$D(w) = f'^{-1}(w(1 + \tau)).$$

If L^* and w^* denote the values of L and w at the initial equilibrium (given by $D(w^*) = S(w^*) = L^*$), then the value of (L, w) after the policy is enacted is given by the equilibrium condition

$$\frac{D(w)}{L^*} = \frac{S(w)}{L^*} + \alpha\%,$$

or

$$\frac{dw}{w^*} = \frac{\alpha}{(\varepsilon_d + \varepsilon_s)}\%.$$

This implies that the change dL in total effective labor satisfies

$$\frac{dL}{L^*} = -\varepsilon_d \frac{dw}{w^*} = -\frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} \alpha\%,$$

implying that total output decreases in relative terms by

$$\frac{dY}{Y^*} = \frac{w^*(1 + \tau)dL}{Y^*} = \frac{w^*(1 + \tau)dL}{w^*(1 + \tau)L^*} \frac{w^*(1 + \tau)L^*}{Y^*} = s \frac{dL}{L^*} = -\frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} s \alpha\%,$$

which proves (i). If dL_{new} denotes the effective labor supplied by newly hired workers, then the identity

$$\frac{dL}{L^*} = \frac{dL_{new}}{L^*} + \alpha\%$$

implies that

$$\frac{dL_{new}}{L^*} = \frac{\varepsilon_s}{\varepsilon_d + \varepsilon_s} \alpha\%,$$

so that

$$\frac{d\Lambda_{new}}{\Lambda^*} = \frac{w_{ave}}{\tilde{w}} \frac{dL_{new}}{L^*} = \frac{w_{ave}}{\tilde{w}} \frac{\varepsilon_s}{\varepsilon_d + \varepsilon_s} \alpha\%,$$

which is (ii). To prove (iii), we start by assessing the cost to the government of removing working hours corresponding to $\alpha\%$ of total wages with a compensation rate of λ . The government pays total compensation equal to $\lambda\alpha w^* L^*$, and the change in tax revenue is $\tau.dY = \tau w^* dL = -\tau \frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} \alpha w^* L^* \%$. Therefore the total cost is equal to $\alpha w^* L^* (\lambda + \tau \frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s}) \%$. The number of new jobs being equal to $dL_{new} \frac{w^*}{\tilde{w}}$, this implies that the cost of every new job is equal to $\tilde{w} [(1 + \varepsilon_d \varepsilon_s^{-1}) \lambda + \varepsilon_d \varepsilon_s^{-1} \tau]$, which is (iii).

Proof of Proposition 4:

Assume that the rate of payroll taxes is decreased by $\alpha\%$. The new equilibrium value of w satisfies

$$D(w(1 + \tau - \alpha)) = S(w),$$

while the initial values L^* and w^* satisfy

$$D((1 + \tau)w^*) = S(w^*) = L^*.$$

This implies that

$$\frac{dw}{w} = \frac{\varepsilon_d}{\varepsilon_d + \varepsilon_s} \alpha\%,$$

and

$$\frac{dL}{L^*} = \frac{\varepsilon_d \varepsilon_s}{\varepsilon_d + \varepsilon_s} \alpha\% = (\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} \alpha\%.$$

The change in output is equal to the change in effective labor times the wage paid by employers, or

$$\frac{dY}{Y^*} = s(\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} \alpha\%,$$

which is (i). As in the proof of Proposition 3,

$$\frac{d\Lambda}{\Lambda^*} = \frac{w_{ave}}{\tilde{w}} \frac{dL}{L^*},$$

yielding (ii). Finally, decreasing payroll taxes by $\alpha\%$ costs the government $\alpha w^* L^*$, and the number of new jobs is

$$d\Lambda = \Lambda^* \frac{d\Lambda}{\Lambda^*} = \frac{d\Lambda}{\Lambda^*} \frac{w^* L^*}{w_{ave}} = \frac{w^* L^*}{\tilde{w}} \frac{dL}{L^*} = \frac{w^* L^*}{\tilde{w}} (\varepsilon_d^{-1} + \varepsilon_s^{-1})^{-1} \alpha \%.$$

Since every new job increases tax revenue by $\tau \tilde{w}$ on average, the average cost per new job is $\tilde{w}(\varepsilon_d^{-1} + \varepsilon_s^{-1} - \tau)$, which proves (iii).

Derivation of ε_d when there are two kinds of labor inputs (section 5.1):

In our basic model, increasing labor force by 1%, with all new workers having ability i_{\min} , causes an increase in effective labor by $\frac{w_{\min}}{w_{ave}}\%$, and, therefore, a decrease in every agent's marginal productivity by $\frac{w_{\min}}{w_{ave}} \frac{1}{\varepsilon_d} \%$.

If there are two kinds of labor inputs, as modeled in section 5.1, with an elasticity of substitution of ε between unskilled labor and the combination of capital and skilled labor, then increasing labor force by 1%, with all new workers having ability i_{\min} , causes an increase in effective unskilled labor by $\frac{w_{\min}}{w_u} \frac{(\Lambda_s + \Lambda_u)}{\Lambda_u} \%$ (with Λ_s and Λ_u being respectively the size of the skilled and unskilled population, and w_u being the average unskilled wage), causing a decrease in the marginal productivity of unskilled labor (measured in efficiency units) equal to

$$\frac{w_{\min}}{w_u} \frac{(\Lambda_s + \Lambda_u)}{\Lambda_u} \frac{1}{\varepsilon} \frac{1}{1 - s_u} \%,$$

where s_u is the share of output accruing to unskilled labor. Equalizing this expression with the one above implies that

$$\varepsilon_d = \varepsilon \frac{w_u \Lambda_u}{w_{ave}(\Lambda_s + \Lambda_u)} \frac{1}{1 - s_u}.$$

Derivation of ε_s from the results of Laroque and Salanie [1999]:

Laroque and Salanié show, first, that changes in employment are mostly due to changes in how binding the minimum wage is, that is, to changes in involuntary unemployment. This means that ε_s is small compared to β , so that we can apply the corollary to Proposition 5. They model an economy

where individual productivity depends only on individual characteristics (and a random term), but not on the number of active workers. This amounts to assuming that the wage per unit of efficient labor is constant, implying that $\varepsilon_d = \infty$ ²⁸. On the basis of this assumption and of the wage and participation equation they find, Laroque and Salanié estimate that the elasticity of total employment with respect to the level of the minimum wage is approximately -0.5. Substituting this value in the corollary to Proposition 5, together with the identity $\varepsilon_d = \infty$, yields

$$0.5 = \left(\frac{w_{\min}}{w_{ave}} \varepsilon_d^{-1} + \beta^{-1} \right)^{-1} = \beta,$$

as we claim in Section 5.2.

²⁸Under this assumption, malthusian policies are completely inefficient even in the short-run. This explains why the authors do not consider its effects in the policy section of their paper.

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